OUR ASTRONOMICAL COLUMN

ASTRONOMICAL OCCURRENCES IN OCTOBER.

Oct. 6. 13h. 35m. to 14h. 29m. Moon occults κ Piscium (mag. 5).
9. 10h. 42m. Minimum of Algol (β Persei).
11. 6h. 51m. Transit (egress) of Jupiter's Sat. III.
11. 8h. 47m. to 9h. 25m. Moon occults ω^2 Tauri (mag. 4·6).
12. 7h. 30m. Minimum of Algol (β Persei).
12. 18h. 36m. to 19h. 23m. Moon occults ζ Tauri (mag. 3).
13. 15h. to 15h. 43m. Moon occults ν Geminorum (mag. 4).
15. Venus. Illuminated portion of disc = 0·637.
15. Mars. ,, ,, ,, = 0·902.
16. 17h. 26m. to 18h. 30m. Moon occults κ Cancri (mag. 5).
17. Saturn. Outer minor axis of outer ring = 16″·68.
19. 10h. Conjunction of Jupiter and Uranus. Jupiter, 0° 25′ N.
19–21. Epoch of Orionid meteoric shower. (Radiant 91°+15°.)
26. 12h. Conjunction of Jupiter and moon. Jupiter, 0° 27′ S.
28. 6h. 21m. Jupiter's Sat. IV. in conjunction S. of planet.
28. Probable date of perihelion of Barnard's comet (1884 II.).
29. 8h. 27m. to 8h. 46m. Moon occults *d* Sagittarii (mag. 4·9).
29. 16h. Mercury at greatest elongation (23° 46′ E.).

THE FIREBALL OF SUNDAY, SEPTEMBER 2, 6h. 54m.—A very large number of observations of this brilliant object were made, but they were not very exact, as the meteor appeared in daylight. The radiant point was probably in Cepheus at about 334°+57°. The object, during its visible flight, appears to have descended from a height of eighty-five miles over Richmond, Yorks., to twenty miles over Fleetwood, Lancs., and to have traversed a path of eighty-four miles. Another fine meteor was observed on Sunday evening, September 16, at 8h. 44m., and descriptions have come from London, Birmingham, Oxford and Llanelly. The radiant was in the southern sky between Capricornus and Piscis Australis at 324°−25°. The meteor fell from about fifty miles over Bewdley to thirty-two miles over Wigan, and had a visible course of eighty-six miles. The velocity is somewhat doubtful.

EPHEMERIS FOR OBSERVATIONS OF EROS:—

1900.		R.A. h. m. s.		Decl. ° ′ ″
Sept. 27	...	2 43 7·41	...	+43 27 2·0
28	...	43 25·24	...	43 49 43·2
29	...	43 40·01	...	44 12 20·4
30	...	43 51·63	...	44 34 52·7
Oct. 1	...	43 59·96	...	44 57 18·9
2	...	44 4·92	...	45 19 38·2
3	...	44 6·44	...	45 41 50·2
4	...	2 44 4·44	...	+46 3 53·8

The co-operative observations for determinations of parallax will commence about the beginning of October. The planet is at present in the constellation Perseus, and passes the meridian of London about 2·40 a.m.

EPHEMERIS OF COMET BORRELLY-BROOKS (1900*b*).—This comet is now rapidly becoming fainter, and the following abridgment from a complete Ephemeris furnished by Herr A. Scheller (*Astronomische Nachrichten*, Bd. 153, Nos. 3660, 3663) will doubtless suffice for observers possessed of the necessary optical power:—

Ephemeris for 12h. Berlin Mean Time.

1900.		R.A. h. m. s.		Decl. ° ′		Br.
Sept. 29	...	14 26 34	...	+69 7·7	...	0·07
Oct. 3	...	32 53	...	68 11·0	...	·06
7	..	38 55	...	67 24·5	...	·06
11	...	44 50	...	66 47·3	...	·05
15	...	50 38	...	66 18·7	...	·04
19	...	14 56 27	...	65 58·3	...	·04
23	...	15 2 16	...	65 45·6	...	·03
27	...	8 8	...	65 40·4	...	·03
31	...	15 14 2	...	+65 42·4	...	0·03

AUTOMATIC PHOTOGRAPHY OF THE CORONA.—Mention has often been previously made of Prof. C. Burckhalter's ingenious apparatus for obtaining photographs of the solar corona during an eclipse, and it now appears that he was extremely successful at the eclipse in May last. *Popular Astronomy*, vol. viii., contains reproductions from two negatives of the corona secured by him, one uncontrolled as has hitherto been usual, the other the result of intercepting part of the coronal light for varying periods of time during the total exposure. The total exposure in each case was 8·0 seconds, but by means of a system of revolving diaphragms arranged in one of the cameras, the image was shielded in various regions for different times, thus permitting the details of the inner corona to be photographed on the same plate as the outermost faint streamers. The following are the calculated effective exposures at the several stated distances from the moon's centre (moon's semi-diameter = 15′ 58″).

Distance from moon's centre	16′	...	20′	...	32′	...	50′	...	110
Exposure	... 0·04s.	...	0·23s.	...	1·76s.	...	3·20s.	...	8·00s.

The photograph shows the inner coronal detail close to the limb of the moon, the outer streamers extending for more than a lunar diameter. Several of the inner coronal tufts appear to be projected on the long broader streamers as background.

THE IRON AND STEEL INSTITUTE.

THE Iron and Steel Institute held its autumn meeting in Paris on September 18 and 19, under the presidency of Sir William Roberts-Austen, K.C.B., F.R.S. Besides a long programme of ten papers, visits to the Exhibition, to the works at St. Chamond, at Hayange in Lorraine, and at St. Denis near Paris, were arranged by an influential reception committee, of which Mr. Robert de Wendel was president and Mr. Henri Vastin honorary secretary. The attendance was unusually large, and the meeting was in every respect a successful one. The proceedings began on September 18 at the house of the Société d'Encouragement, with an address of welcome by Mr. Robert de Wendel, president of the French Association of Ironmasters. Sir William Roberts-Austen, having acknowledged the welcome, delivered a presidential address dealing in faultless literary style with the history of metallurgy in France.

The first paper read by the secretary, Mr. Bennett Brough, was by Mr. H. Pinget, secretary of the Comité des Forges, and dealt with the development of the iron industry in France since the Institute's last visit to Paris in 1889. The increase in output of iron and steel has been much greater than it was in the interval between the two previous exhibitions in Paris. No striking technical invention has been made, but great progress has been effected in increasing the power of the appliances used and in improving the quality of the products. There is a marked tendency to replace cast iron by cast steel, and success has attended endeavours to cast complicated forms in metal which is both tough and of high tensile strength. Moreover, special steels are now available for the requirements of particular applications, such as the growing exigencies of armour plate. The discussion on this paper was confined to complimentary remarks from Sir Lowthian Bell, F.R.S., Mr. Greiner and others.

The second paper, the most important submitted to the meeting, was that by Mr. J. E. Stead on iron and phosphorus. It is typical of modern metallurgical research, and contains a mass of original observations showing how phosphorus occurs in iron and steel. The subject is dealt with in four sections: (1) the constitution, properties and microstructure of iron containing form traces to 24 per cent. of phosphorus; (2) the effect of carbon when introduced by the fusion or cementation process into iron containing phosphorus; (3) the microstructure of pig iron containing phosphorus; and (4) the diffusion of solid phosphide of iron into iron. There are appended to the paper useful notes on eutectics, on solid solutions, on the method of determining free phosphide of iron in iron and steel, and on heat-tinting metal sections for microscopic examination. The observations recorded show that iron will retain as much as 1·75 per cent. of phosphorus as phosphide in solid solution, and that when more than that is present, the excess separates and is found as free phosphide of iron mixed up with the mass of iron. It is also shown that carbon added to solid solutions of phosphorus in iron throws out of solution the dissolved phosphide, which appears in a separate state. The most remarkable result given indicates that when carbon is added by the cementation process, the phosphide, when in large quantity, is thrown, not only out of solution, but escapes entirely out of the metal as a liquid eutectic leaving a constant residuum behind. A method is described by which phosphorus compounds in pig iron can be identified by means of the microscope. This consists in simply heating the polished surfaces to about 300° C. for a few minutes, when each constituent takes a different oxidation tint. The iron acquires a sky-blue colour, the carbide a red-brown and the phosphide compound a pale yellow. The coloured sections are of great beauty. Many results are given showing how the solid phosphide diffuses in solid iron, and showing that under suitable conditions well-formed crystals will grow in solid metal.

Mr. H. Bauerman's paper on iron and steel at the Universal Exhibition, Paris, 1900, was prepared mainly for the use of the members of the Institute visiting the Exhibition during the meeting. It contained a critical description of the more prominent metallurgical exhibits, and forms a valuable record of the condition of the metallurgical industry at the close of the century.

On September 19, the remaining papers on the programme were dealt with. Chief among these was that by Mr. E. F. Lange, on a new method of producing high temperatures. The principle underlying the process, which is the outcome of researches made by Dr. H. Goldschmidt of Essen, is not new, as it is based upon the heat energy developed by the chemical action of aluminium upon oxygen, or rather that between aluminium and certain metallic oxides. The practicability of the process was clearly shown by the welding together during the meeting of two short lengths of heavy girder rails. The method not only opens up a new field for aluminium but also promises to be of considerable importance in engineering work. In the discussion Sir William Roberts-Austen pointed out the extreme precision with which the reduction took place, and Sir Lowthian Bell dwelt on the value of the process if it should prove that carbonless iron could be obtained by it for electrical purposes.

The paper by Mr. A. L. Colby, of Bethlehem, United States, on American standard specifications and methods of testing iron and steel, embodied the results of over a year's work by a committee of American experts, conducted with a view to the adoption of international standards. Some of the specifications were criticised by Mr. R. A. Hadfield. The engineer, he thought, was encroaching on the field of the metallurgist. Interesting contributions to the discussion were made by Mr. C. P. Sandberg and by Dr. Dudley, of Pennsylvania.

In a paper on the influence of aluminium on the carbon in cast-iron, Mr. G. Melland and Mr. H. W. Waldron gave the results of an elaborate research in which they endeavoured to determine the amount of aluminium which is necessary to produce the maximum separation of graphite in a white pig-iron as free as possible from silicon and other impurities, and to ascertain, by casting every melting both in sand and in chill moulds, the effect produced by slow and rapid cooling upon the mode of existence of the carbon in the metal with amounts of aluminium varying from 0·02 to 12 per cent.

In the paper by Mr. Louis Katona, of Resicza, Hungary, the various disadvantages of the rolling-mills now in use were discussed, and suggestions were made for obviating them with a view to increasing the output and lessening the fuel consumption.

In a lengthy paper on the constitution of slags, which was taken as read, Baron H. von Jüptner discussed iron slags from a modern point of view, and described the varying reactions which take place between them and iron. The slags considered are divided into three groups—silicate slags, phosphate slags and oxide slags. The results of the investigation tend to show that slags should be regarded as solutions, and not as complicated chemical compounds.

The "phase-rule" of Gibb has served as a guide to the authors of two well-reasoned papers of great scientific interest—one on iron and steel from the point of view of the phase doctrine, by Prof. Bakhuis-Roozeboom, of Amsterdam, and the other on the present position of the solution theory of carburised iron, by Dr. A. Stansfield. The phase rule says in effect that in a system such as that of the carburised irons, in which two distinct substances (carbon and iron) are involved, but in which certain forms or phases of carbon or iron, or carbon-iron solution, or carbon-iron compound, are present, no more than two of these phases can exist in equilibrium with each other at a particular temperature. In the case of a solution of salt in water, this would mean that there could only be salt and ice and solution together at a particular temperature (the eutectic temperature), and that at any other temperature there could only be ice and solution or salt and solution (at temperatures above the eutectic), or ice and salt (at temperatures below the eutectic). In the case of a salt solution this is quite evident, but the value of the phase rule is that we can apply it with equal confidence in cases where we do not, to begin with, know the answer to our question. Applying the rule to the case of solid carburised iron at temperatures above that of all the known allotropic charges—we have the four possible substances of iron, graphite, cementite and solid solution of carbon (either graphite or cementite) in pig-iron. The rule states that only two of these can in general exist permanently together. The general conclusions to be drawn from Dr. Stansfield's researches are :—

(1) That carbon is less soluble in iron when presented in the form of graphite than when presented in the form of cementite.

(2) That the apparent reversal of this in steel is due partly to the absence of nuclei of graphite on which further deposits might take place ; partly to the length of time required for the separation of the graphite, involving, as it does, the gradual passage of carbon through the iron to reach the nuclei, and partly to the mechanical pressure which must oppose the formation of graphite in solid steel.

The meeting was brought to a close by a vote of thanks to the French authorities and societies, whose hospitality had been enjoyed, proposed by the president and seconded by Mr. W. Whitwell, president-elect. A vote of thanks to the president was proposed by Mr. Greiner, of Seraing, Belgium, and seconded by Mr. Nordenfelt. The social functions in connection with the meeting were of a very attractive character. They included an operatic entertainment organised by the Comité des Forges, a reception by the Commissioner-General and Mrs. Jekyll at the British Royal Pavilion, a banquet at the Hôtel Continental, a reception by Mr. E. Schneider in the Le Creusot pavilion, a reception at the Hôtel de Ville by the president of the Municipal Council, and a reception on September 24 by the Minister of Public Works.

THE BRADFORD MEETING OF THE BRITISH ASSOCIATION.

SECTION K.

BOTANY.

OPENING ADDRESS BY PROF. S. H. VINES, M.A., D.SC., F.R.S., PRESIDENT OF THE SECTION.

THERE has been considerable difference of opinion as to whether the present year marks the close of the nineteenth or the beginning of the twentieth century. But whatever may be the right or the wrong of this vexed question, the fact that the year-date now begins with 19, instead of with 18, suggests the appropriateness of devoting an occasion such as the present to a review of the century which has closed, as some will have it, or, in the opinion of others, is about to close. I therefore propose to address you upon the progress of Botany during the nineteenth century.

I am fully conscious of the magnitude of the task which I am undertaking, more especially in its relation to the limits of time and space at my disposal. So eventful has the period been that to give in any detail an account of what has been accomplished during the last hundred years would mean to write the larger half of the entire history of Botany. This being so, it might appear almost hopeless to attempt to deal with so large a subject in a Presidential Address. But I trust that the very restrictions under which I labour may prove to be rather advantageous than otherwise, inasmuch as they compel me to confine attention to what is of primary importance, and thus to give special prominence to the main lines along which the development of the science has proceeded.

Statistics.

We may well begin with what is, after all, the most fundamental matter, viz. the relative numbers of known species of plants at the beginning and at the end of the century. It might appear that the statistics of plants was a subject susceptible of very simple treatment, but unfortunately this is not the case. It must be remembered that a "species" is not an invariable